TEMPERATURE AND RELATIVE HUMIDITY SENSOR HTS2010SMD

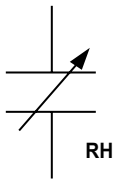
*Based on a unique **capacitive cell for humidity** measurement and a **Negative Temperature Coefficient** (NTC) thermistor for temperature measurement, this dual purpose relative humidity / temperature miniaturized sensor is designed for high volume, **cost sensitive applications with tight space constraints.** It is useful in all applications where **dew point, absolute humidity measurements** or humidity compensation are required.*

MAIN FEATURES

HTS2010SMD

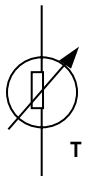
- **Miniature Surface mount SMD package**
- Compatible with automated assembly processes, **including wave soldering, water immersion and reflow soldering**
- **Full interchangeability** with no calibration required in standard conditions
- High reliability and long term stability

HUMIDITY SENSOR SPECIFIC FEATURES



- **Instantaneous desaturation** after long periods in saturation phase
- Patented solid polymer structure
- Suitable for linear voltage or frequency output circuitry
- Fast response time

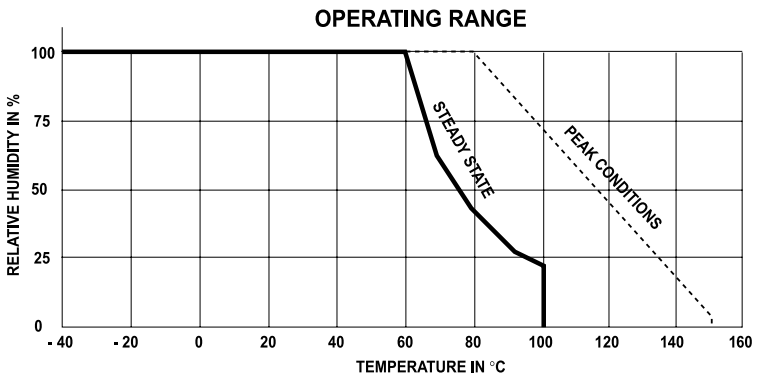
TEMPERATURE SENSOR SPECIFIC FEATURES



- **High quality** thermistor
- Stable
- High sensitivity

MAXIMUM RATINGS (Ta = 25°C unless otherwise noted)

Ratings	Symbol	Value	Unit
Storage Temperature	Tstg	- 40 to 100	°C
Supply Voltage on humidity cell	Vs	10	Vac
Humidity Operating Range	RH	0 to 100	% RH
Temperature Operating Range	Ta	- 40 to 100	°C
Maximum Electric Power to be supplied (continuous) @ 25°C	P25	2	mW



CHARACTERISTICS

Humidity sensor (Ta = 25°C, V_S = 5 volts, measurement frequency @ 10 kHz unless otherwise noted)

Characteristics	Symbol	Min.	Typ.	Max.	Unit.
Humidity measuring range	RH	1		99	%
Nominal capacitance @ 55 % RH*	C	177	180	183	pF
Averaged Sensitivity from 33 % to 75 % RH	ΔC/%RH		0.34		pF/%RH
Long term stability			0.5		%RH/yr
Recovery time after 150 hours of condensation			10		s
Response time (33 to 76 % RH, static, @ 63 %)	τ		10		s

CHARACTERISTICS (CONT)

Humidity sensor (Ta = 25°C, measurement frequency @ 10 kHz unless otherwise noted)

Characteristics	Symbol	Min.	Typ.	Max.	Unit.
Temperature coefficient at 55 % RH / 10 to 40°C	Tcc		+ 0.04		pF/°C
Humidity Hysteresis			+/-1.5		% RH
Deviation to typical curve (see below) (10 % to 90 % RH)			+/-2		% RH
Supply voltage	Vs	1	5	10	Vac
Leakage current (Vs = 5 volts)	I_x			1	nA

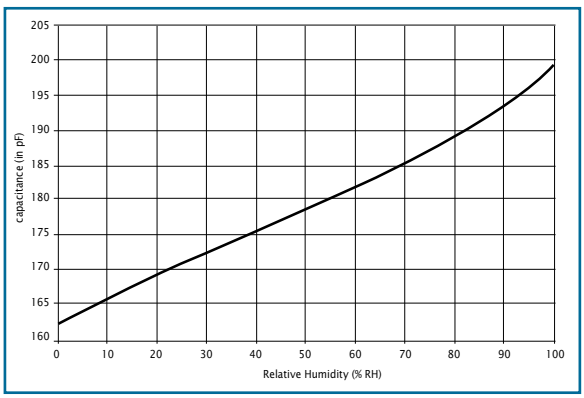
***Tighter tolerance available on request**

Temperature sensor

Characteristics	Symbol	Min.	Typ.	Max.	Unit.
Nominal resistance @ 25°C			10		kΩ
Beta value : B25/100	B	3600	3730	3800	
Temperature measuring range	Ta	- 40		100	°C
Nominal Resistance Tolerance*	Rn		2	3	%
B value tolerance	B		3		%
Response Time	τ		10		s

***Tighter tolerance available on request**

Typical response curve of HTS2010SMD in humidity



Calibration data are traceable to NIST standards through CETIAT laboratory.

Measurement frequency : 10 kHz
Ta = 25°C

Polynomial response :

$$C = C@55\% * (1.25\,10^{-7} RH^3 - 1.36\,10^{-5} RH^2 + 2.19\,10^{-3} RH + 9.0\,10^{-1})$$

C in pF, RH in %

Typical temperature output

Depending on the needed temperature measurement range and the associated accuracy, we suggest two methods to access to the NTC resistance values.

① $$R_T = R_N - e^{B\left(\frac{1}{T} - \frac{1}{T_N}\right)}$$

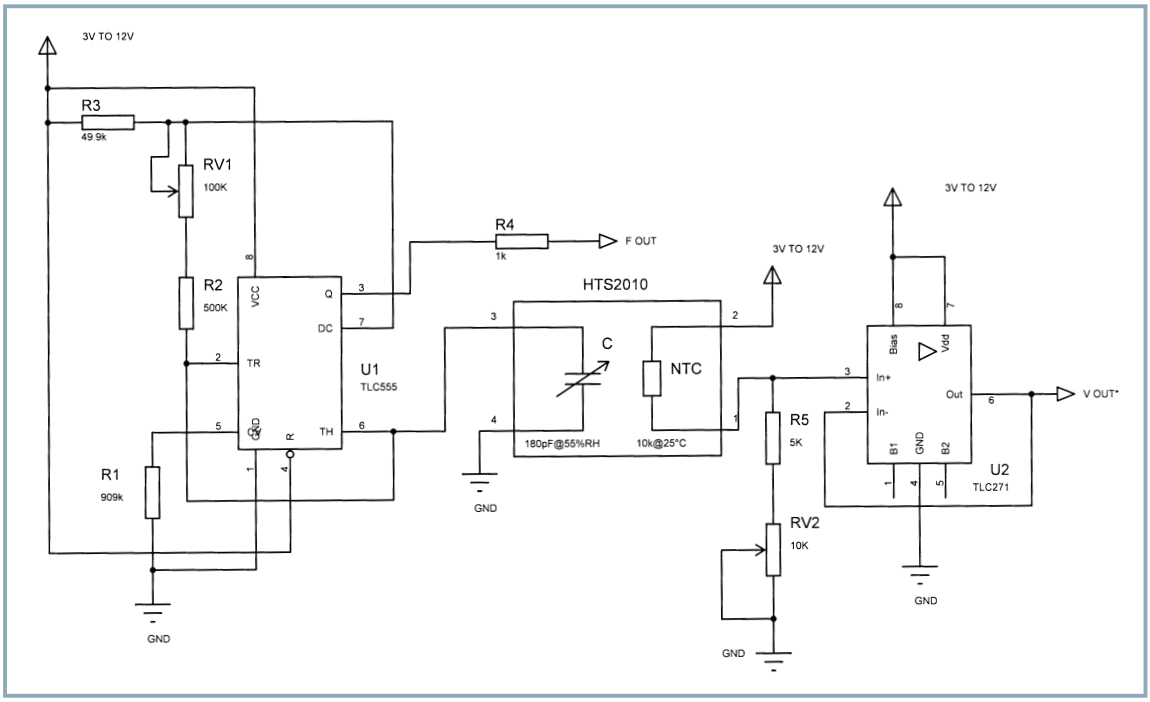
R_T NTC resistance in Ω at temperature T in K
R_N NTC resistance in Ω at rated temperature in K
T, T_N Temperature in K
B B value, material-specific constant of the NTC thermistor
e Base of natural logarithm (e = 2,71828)

The actual characteristic of an NTC thermistor can, however, only be roughly described by the exponential relation, as the material parameter B in reality also depends on temperature. So this approach is only suitable for describing a restricted range around the rated temperature or resistance with sufficient accuracy.

② For practical applications a more precise description of the real R/T curve may be required. Either more complicated approaches (e.g the Steinhart-Hart equation) are used or the resistance/temperature relation as given in tabulated from. These standardized curves have been experimentally determined with utmost accuracy ; they are aslo available for temperature increments of 1 degree.

R NTC standardized				R NTC exponential			
°C	ohm	°C	ohm	°C	ohm	°C	ohm
-40	262960	**35**	6734	**-40**		**35**	6670
-35	194110	**40**	5575	**-35**		**40**	5500
-30	144790	**45**	4636	**-30**		**45**	4550
-25	109030	**50**	3874	**-25**		**50**	3800
-20	82923	**55**	3237	**-20**		**55**	3180
-15	63591	**60**	2720	**-15**		**60**	2690
-10	49204	**65**	2304	**-10**	52000	**65**	2270
-5	38279	**70**	1960	**-5**	40500	**70**	1940
0	30029	**75**	1674	**0**	31000	**75**	1650
5	23773	**80**	1432	**5**	24500	**80**	1430
10	18959	**85**	1235	**10**	19300	**85**	1230
15	15207	**90**	1067	**15**	15400	**90**	1070
20	12280	**95**	927	**20**	12350	**95**	925
25	10000	**100**	809	**25**	10000	**100**	810
30	8178			**30**	8140		

SUGGESTED EVALUATION CIRCUIT FOR HUMIDITY FREQUENCY AND TEMPERATURE ANALOG OUTPUTS



Relative humidity (Frequency output)

This circuit is a typical Astable design for 555. The HTS2010 is used as a variable capacitor and provides an output frequency modulation with relative humidity ranging from 0% to 100%.

In this frequency output circuit configuration (for capacitance measurement), R1 unbalances the internal temperature compensation scheme of the 555. It shifts the negative initial temperature coefficient of the 555 to a positive one that matches the humidity sensing chip's temperature coefficient of - 1.4Hz/°C. In all cases, R1 should be a 1 % resistor with a maximum of 100ppm temperature coefficient like all other R-C timer resistors.

Resistors values

Since 555 internal temperature compensation changes from manufacturer to manufacturer, R1 and R2 values should be adapted to device to be used.

555	R1	R2
TLC555 (Texas)	909kΩ	576kΩ
TS555 (STM)	100nF capacitor	523kΩ
7555 (Harris)	1732kΩ	549kΩ
LMC555 (National)	1238kΩ	562k

For a frequency of 6660Hz at 55%RH

Temperature (voltage output)

The temperature measurement is done by a voltage divider, RV2 must be adjusted to get 2.5 V at 25°C as temperature measurement.

Polarization

In order to get better reproducibility during measurement, always connect pin 4 (see the package outline on page 4) to the ground of the circuit.

Soldering instructions

See application note HPC 034 VO

QUALIFICATION PROCESS

HTS2010SMD sensors have been qualified through a complete qualification process taking in account many of the requirements of the MIL STD750 including :

Solder heat and solderability

Wave soldering at 260˚C + DI water clean at 45˚C

Mechanical shock - 1500 g, 5 blows, 3 directions

Vibration - Variable (F = 100 - 2000Hz), fixed (F = 35Hz)

Constant acceleration

Marking permanency

ESD - Electrostatic Discharge - Human body & Machine model

Salt Atmosphere MIL STD750/Method 1041/96 hours

Temperature Cycling – -40˚C / +70˚C

High Temperature / Humidity Operating Life - 93% RH / 60˚C for 1000 hours

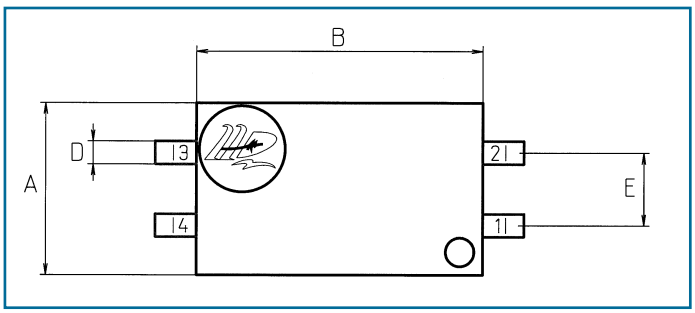
Low humidity storage life - RH < 10%/23˚C - 1000 hours

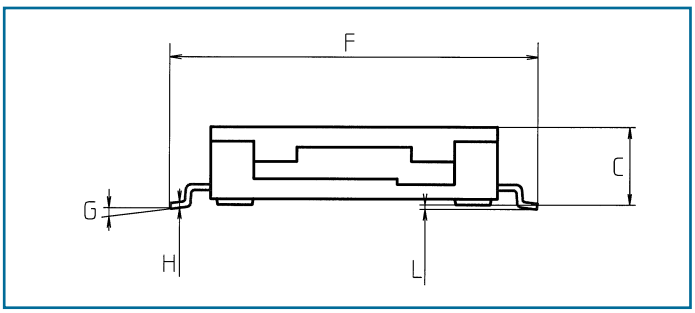
Resistance to immersion in water at ambient temperature and 80˚C - 160 hours

Resistance to acid vapors at 75000 ppm for nitric, sulfuric and chlorhydric acids

Resistance to many chemicals linked with home appliances/ automative or consumer applications.

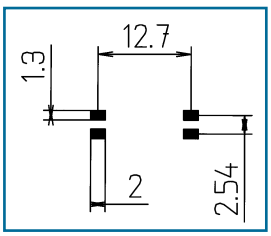
PACKAGE OUTLINE HTS2010SMD **GULL WING** (JLEAD option also available).





RECOMMENDED FOOTPRINT

All dimensions in mm
Scale 1:1



Dimension	A	B	C	D	E	F	G	H	L
mm (typical)	6	10	2.7	0.8	2.54	12.8	0-7°	0.2	0.1

ORDERING INFORMATION (MULTIPLE PACKAGE QUANTITY OF 80 PIECES).
HTS 2010 SMD : HUMIDITY ANALOG VOLTAGE OUTPUT MODULE

SAMPLE KIT OF HTS 2010 IS AVAILABLE THROUGH HUMIREL WEB SITE

www.humirel.com

email : sales@humirel.com